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P A P E R

I N

C H E M I S T R Y.

C H E M I S T R Y.

THE many and great uses to which Alkaline Salts are applied in various branches of Manufacture, as Soap making, Glafs making, Bleaching, &c. &c. have rendered these Salts an object of the Society's confideration ; and different premiums have been offered with a view to the obtaining them at a cheaper rate than they have hitherto been fold at. Among others, the Society in the year 1776, first offered their GOLD MEDAL, or THIRTY POUNDS, to the person who should import into the Port of London, in the year 1777, not less than ten hundred weight of native fossil fixt Alkali,

the produce of any part of the British Dominions in the East Indies, and fit for the purpose of Soap Makers. This Premium was continued without any claim being made for it, to the year 1785, and then discontinued.

Towards the latter end of the last mentioned year, an account was received by the Society, that a quantity of native fossil Alkali, had been sent from Bombay, by HELLENUS SCOTT, Esq; Surgeon there: And in April 1786, about three hundred weight, part unrefined and part refined, was by order of the Court of Directors of the Honourable East India Company, delivered to the Society; who having procured trials to be made of its properties, and its value ascertained by some very ingenious Chemists and Manufacturers. Resolved, “ that this substance being a
“ mild

“ mild fossil Alkali, would prove a de-
 “ firable article in Commerce, provided
 “ its price did not exceed that of Ba-
 “ rilla ; and being the produce of one
 “ of the British possessions in the East
 “ Indies, it would be more advantageous
 “ to have the Alkali from thence, than
 “ to purchase Barilla, from foreign
 “ Parts, often at an exorbitant price.”

The Society therefore presented their
 SILVER MEDAL to Mr SCOTT, for
 his having produced to them this sample
 of native Indian fossil Alkali.

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The following Letters and Papers, contain the opinions of some persons of established abilities, communicated to the Society on this subject.

THERE are few articles of more extensive utility to mankind, than Alkaline Salts ; and perhaps there is no Country in Europe, where they are more generally used, or produced in smaller quantity than they are in England. They are absolutely necessary in Dying, in Medicine, and in making of Glafs ; they are also the basis of Soap and Leys, besides their use in a variety of arts. For these reasons, every Society with us, for the improvement of Commerce and the useful Arts, has offered premiums for the production of these Salts in the British Dominions, but hitherto they have not succeeded. They have indeed from
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vegetable matters, been able to make some quantity of the vegetable Alkali, like the Potash of the northern Countries, but they have not been so successful with regard to the fossil Alkali, which is of the same nature as the Barilla of Spain. We therefore are obliged to depend on Russia, and the nations on the Baltic, for the vegetable Alkali ; and on Spain, and the Countries on the Mediterranean, for the Fossil. This has made the last mentioned kind so dear, during the war, that many Manufactures depending on it, have been entirely suspended.

From these considerations, it might be a desirable thing to send from this Country, (Bombay) a Salt of that nature. By the experiments I have made, it appears we have a good fossil Alkali produced here in a rude state, of the same qualities with the Alkali of Spain, and fit for all the purposes

purposes in arts to which that Alkali is applied.

Since I first mentioned to some gentlemen here, the advantages that might be derived from purifying this article, and sending it to England; I have learned that it now is sent from Bengal, by contract, and in considerable quantities, at the rate of twelve Rupees, a Maund of nearly eighty-two pounds averdupois.

The quantity of Salt that might be got here every year must be considerable, and may amount to four or five hundred tons or more; as it would answer for vessels deficient in their loading, the expense of transporting it could not be great.

I therefore beg leave to offer to your Honourable Board, to supply the Company

pany with the quantity of two hundred tons every year, or with a greater quantity if it is desired and can be procured; and this at the rate of three hundred Rupees a ton, which is fifty less than is allowed at Bengal, for the same quantity.

I doubt not, in case this proposal appears reasonable, your Honours will afford every encouragement for its advancement, as it has for its object the production of an article the most necessary in many of the arts of life, in a Country where they have arrived at the highest perfection, and where it is by nature almost entirely denied.

I shall only take the liberty to add, that as the Salt with which I propose the Company should be supplied, will in no respect be inferior to the Salt of Bengal, as the cost of it will not be greater, if so
great ;

great; and as the quantity will be very considerable, I humbly suppose the same advantages may be procured by sending it from this Coast, as from the other side of India.

Bombay, January 2, 1785.

S I R,

I Did myself the honour of writing to you about a month ago by the Resolution Indiaman, Captain TOLMEY, and sending a box of native Fossil Alkali, which I suppose before the arrival of this letter, has been presented you by Lieut. General MELVILL. I informed you, that on this Coast, I had observed the natives in the use of washing their cloaths with a brown earth, which on examination, I found to be a native fixed Alkali.

As

As this substance, I believe, has been much wished for as a product of some part of the British Dominions, I have proposed supplying it to the extent of many hundred tons, every year, on the Company's account. The Honourable the Governour and Council, have sent that proposal home for the consideration of the Court of Directors.

At present, I send a box of this Alkali to the Society for the Encouragement of Arts, Manufactures and Commerce, in hopes that learned Society, will consider it a matter of use as well as curiosity ; and that they will recommend a proposal to the Court of Directors, by which an inexhaustible supply of that most useful article, will arise to the Nation, in time of war as well as in peace.

As the ships from this Coast, seldom go home fully laden, it might be taken
in

in as ballast, by which the expense of transporting it would be inconsiderable.

In the state in which I have sent this, it would not exceed one hundred Rupees a ton, and perhaps is pure enough for many Manufactures. I have before informed you that this Salt is found in Sindhy, in the ground near the sea, from whence the natives dig it.

If the Society for the Encouragement of Arts, Manufactures and Commerce, should honour me with any information on this subject, (as whether it would be proper to purify it farther before sending it home ; or whether in this state, as it is cheaper and more fit for carriage, it is to be preferred.)

My address is, Mr Scott, Surgeon, Bombay.

I am, Sir,

Your obedient Servant,

H. SCOTT.

Bombay,

Bombay, November 20, 1784.

S I R,

THE attention paid by the Society for the Encouragement of Arts, Manufactures and Commerce, to Alkaline Salts, made me first think on that subject in this Country ; I therefore beg leave to lay before you a discovery I have made of great quantities of a fossil Alkali, produced on this Coast by nature, and not the product of fire. I venture to call this a discovery, as I am, as far as I know, the first European who has been acquainted with the qualities of this substance.

When I arrived in India, I saw in common use among the natives, a Soap manufactured on this Coast, but I never could procure any of the Salt of which it is composed. I also had heard of Glafs being made at Surat. A long while af-

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terwards, I observed that the natives are in the use of washing their cloaths with a brown earth brought from Sindy. I found this to be a fossil Alkali, with a considerable portion of earthy and vegetable matters.

This Salt is produced in pits near the sea, and in immense quantities. I believe it might be procured to the extent of many thousand tons every year. Thinking from the immense quantities of this Salt, and from its particular nature, being a native fossil Alkali, it might become an object of publick use, I laid before the Honourable the Governor and Council here, the proposal which I have enclosed. They have referred the matter to the Court of Directors, only agreeing to send home a small quantity every year as a specimen, until their pleasure is known.

By

By the Company's ship Resolution, I have sent a box of the Alkali, in the state in which it is found in Sind, to the Society for the Encouragement of Arts, Manufactures and Commerce. The Salt in this degree of purity, would not exceed one hundred and fifty Rupees a ton. Perhaps the best state to send it home in, might be that in which it has received a simple-washing; as it is in that state not liable to receive any damage, and would be cheaper than what has undergone the operation of roasting. This I suppose would be sufficiently pure for most of the purposes in the arts.

I cannot help remarking that I find a remarkably small proportion of this NATRUM, sufficient to saturate oil: perhaps this particularity may arise from the Cocoa-nut oil, which is the only kind I have used. If the learned Society for

the Encouragement of Arts, Manufactures and Commerce, should think that this discovery may be of use to the publick, as opening an inexhaustible supply in all times, of a most useful article, I request they will take some notice of it to the Court of Directors, as without their encouragement it must be entirely lost.

I am Sir,

Your obedient Servant,

H. SCOTT.

MR. MORE.

Near

Near Birmingham, April 26, 1786.

DEAR SIR,

I Received your favour of the last month mentioning that you had sent me two samples of fossil Alkali, brought from Bombay, and that the Society for the Encouragement of Arts, are desirous of having them examined to enable them to judge whether they may become an advantageous article of Commerce. You express a wish that the report I shall make of my trials of this Alkali, may be explicit; and I hope in this, and in other respects, you will perceive the readiness and pleasure with which I endeavour to comply with your and the Society's intentions.

I first examined the sample that was marked REFINED; from the taste, I per-

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ceived it was a mild Alkali; and from the dry powdery appearance, I knew it to be of the MINERAL or FOSSIL kind. To determine its strength and purity, I made the following experiments.

E X P E R I M E N T I.

I dissolved ten ounces of this Alkali, and I found it totally soluble, excepting a very small sediment, not exceeding half a grain in weight. This sediment being dissolved by vitriolic acid, yielded a blue Precipitate, on adding the Prussian Alkali, and may therefore be concluded ferruginous. But the quantity is too small to deserve any consideration, with respect to the use of this Alkali in arts, and I suppose it either proceeds from the iron tools and vessels used in its preparation, or may be some vestige of the ferruginous clay

clay with which the Alkali is mixed in its unrefined state, as I shall afterwards shew.

I fet the solution of the Alkali in a cool place to crystalize, and I obtained some very pure crystals of mineral Alkali. The remaining solution having been evaporated a little, yielded upon cooling, more of the same crystals. Upon exposing the liquor to a further evaporation, a crust or pellicle of another Salt was formed, and the crystals of Alkali, which formed upon cooling, were less distinctly shaped than the former, on account of the other Salt, which impeded the crystalization and perfect separation; and which appeared to be chiefly, if not entirely, marine or common Salt. The pure crystals obtained by the two first operations, and which from the peculiar form of the crystals, were easily and certainly known to be mineral Alkali, weighed eight

K 4 ounces

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ounces and a half. But as some Alkali remained in the liquor, we cannot from this experiment infer the quantity either of the Alkali or of the neutral Salt with which it is mixed.

E X P E R I M E N T II.

In order to determine the strength of this refined Indian Alkali, I dissolved a given quantity of it in water, and I found by saturating it with vitriolic acid, that one hundred parts of this Alkali, require for their saturation, fifty-three parts of vitriolic acid, whose density compared with that of water, is in the proportion of eighteen hundred to one thousand.

As I knew from former repeated experiments, that one hundred parts of perfectly dry and pure mild mineral Alkali (that is crystals of Alkali dried as much

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as they can be, in which state they lose their form, and become an opaque white powder) require ninety parts of vitriolic acid, of the above density for their saturation; and as it appeared from the above experiment, that fifty-three parts of this acid were sufficient for the saturation of one hundred parts of the Indian refined Alkali. I inferred that ninety parts of this Indian Salt contains as much Alkali as is equal to fifty-three parts of perfectly dried mild mineral Alkali; or that a hundred parts of the Indian Salt contain fifty-eight eight tenths of such dry Alkali; also because the whole of the substance from India, was soluble, I inferred that the remaining forty-one two tenths out of the hundred, were water or neutral Salt, or both.

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E X P E R I M E N T III.

I had no doubt but some water was contained in this Indian Alkali, therefore in order to find the quantity, I weighed four troy ounces of the Salt, and kept it exposed during two days, to warm air; encreasing the heat by degrees, until it equalled that of boiling water: by this operation, the four ounces were reduced to three ounces and one penny weight; that is, the loss of weight or quantity of water expelled from this Salt by hot air, was nearly twenty-four hundredths of the whole quantity employed: Hence the remaining seventy-six hundredths were dry mild Alkali and neutral Salt. But as fifty-eight, eight tenths, were found by the former experiment, to be dry Alkali, the neutral Salt must be seventeen two tenths.

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E X P E R I M E N T IV.

It remained to be determined of what kind the neutral Salt, or Salts were, if there should be more than one which are mixed with Indian Alkali.

For this purpose, I saturated one troy ounce of this Alkali, with distilled vinegar ; and I added to the saturated solution, drops of a solution of sugar lead, until no more precipitate was thrown down. This precipitate, when dried, weighed fifty-eight grains : I then added in the same gradual manner, a solution of silver in nitrous acid, and the precipitate, when dried, weighed one hundred and sixteen grains.

In order to know whether the first precipitation was occasioned by a vitriolic Salt :

Salt, I tried to dissolve this first precipitate, in distilled vinegar and pure water; and finding that it was soluble, I concluded that neutral Salt which the fugar of lead had decomposed, was not a vitriolic Salt (for the vitriol of lead is not soluble) but a marine Salt; and as the Salt which was decomposed by the solution of silver, was also a marine Salt, I concluded that marine or common Salt, is the only Salt with which the Indian Alkali is mixed, at least in any sensible quantity.

From the experiments of Bergman and other modern Chymists, it is ascertained, that the quantity of acid contained in a hundred parts of Luna Cornea, and Plumbum Corneum, is very nearly equal to the acid contained in fifty parts of common Salt; and thence it may be inferred, that the one hundred and eighty grains

grains of the two precipitates formed in this experiment, indicated the presence of about ninety grains of common Salt in a troy ounce of Indian Alkali, or about eighteen and seven tenths of common Salt, in one hundred parts of the Alkali, which proportion is only about one eighteenth part different from the proportion deduced from the third experiment.

From the above experiments, it appears that one hundred parts of the Indian Alkali, consists of fifty-eight parts, eight tenths of dry mild mineral Alkali, twenty-four parts of water, and seventeen parts two tenths of common Salt.

It appears also the Alkali contained in this Indian Salt, is in a state intermediate, between that of Crystals, which hold a large portion of water, and that of Alkali dried as much as it can be.

It

It may be further proper to observe, that this Alkali must, from the circumstance of its retaining some part of the water of crystallization, be very uncertain in its strength, which will vary, according as it is more or less dry; and the degree of dryness will depend not only on the circumstances of its preparation, but also on the warmth and dryness of the weather, and on the quantity of its surface that is exposed to air; so that the same parcel will be found to vary, sometimes considerably, when tried at different times.

If it be required to form a comparison between the strength of this, and some well known Alkali, it will be found not to differ greatly in strength from Hungarian Pearl Ash; to the average strength of which however, it is rather inferior, in the proportion of five or six per cent.

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However, it is to be understood, when I speak of the strength of these Alkali's, that it refers only to their power of saturating acids, not to their quantities; for it is well known that the mineral Alkali, saturates much more acid than an equal quantity of an equally pure vegetable Alkali; nor to their effects in arts, which possibly may not be in exact proportion to the power of saturating acids.

Having thus ascertained the quality, strength, and degree of purity of the Indian Alkali, the gentlemen of the Society who are conversant in those arts especially, in which Alkali's are employed, will be enabled to form their opinion respecting the application of this commodity to the different manufactures; I shall therefore only submit one or two remarks to their consideration.

No

No commodity is at present brought to market similar to this Indian Salt, either in appearance or in quality, as a refined mineral Alkali ; and this circumstance will for some time at least, impede the introduction of it into use, from the singular aversion which Manufacturers have to trying unknown articles, an aversion not altogether ill founded, for they run some hazard of spoiling their goods when they use a material, with the strength of which and its peculiar mode of treatment they are unacquainted ; time, however, and perseverance will overcome this difficulty.

In considering its utility in making Glafs, it will be proper to distinguish the different branches of this manufacture. For Broad Glafs, Crown Glafs and Bottles, it will scarcely come into consideration, as a substitute for Kelp and Barilla,
because

because it is too valuable for these purposes, and because the earthy part of the Kelp and Barilla contribute, as well as the Saline or Alkaline, to the Vitrification.

IN PLATE GLASS, where the Manufacturers have been used to employ the Salt extracted from Barilla by lixiviation, there seems to be a great probability of its utility; concerning which, the Manufacturers in that branch will be able to give an opinion, when they are informed, that this Indian Alkali, is a Salt of the same kind as that which is extracted from Barilla, and is well refined.

IN FLINT GLASS, it has never been ascertained, whether the Mineral Alkali, is as fit as the Vegetable, which is now solely employed. A very intelligent Manufacturer, (Mr Honeybourne) told me, about two years ago, that he had

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made a trial, in making Flint Glafs, of some Mineral Alkali, which was brought from India at that time, and was offered for fale at a low price, but that it feemed to injure the colour of the Glafs. He gave me a fample of the Alkali, which I found to be very fimilar to that fent to me by you, but fomewhat ftronger. From my own former experiments in making Glafs, I can eafily conceive that the quantity of common Salt contained in this Indian Alkali, muft injure the colour of Flint Glafs, which is very delicate and eafily affected.

The Mineral Alkali, is known to be the fitteft for HARD SOAP; and I therefore can fee no reafon to doubt of the utility of the Indian Salt in this manufacture, if the price does not prevent.

For SOFT SOAP, Mineral Alkali is known to be quite unfit.

I have also examined the sample of **ROUGH UNREFINED ALKALI**, and I find that it consists of a saline matter, and of a quantity of redish ferruginous clay, equal to about eight per cent in weight of the whole mass, upon an average of the three parcels which I tried. This clay gives a colour to the solution of the saline part in water, renders the filtration of this solution difficult, impedes in some measure the crystalization; and consequently the extraction and refining of the Salt, are rendered thereby somewhat tedious, for part of the clay seems to dissolve in the solution, or at least passes through the filter, and forms some kind of union with the saline crystals, the shape and appearance of some of which are thereby altered. The saline matter, when separated from the clay, is a mild mineral Alkali mixed with common Salt, and does not differ in any

respect from the refined Alkali. The rough Alkali contains a larger portion of water than the refined. Its strength or quantity of Alkali contained in it, is to the strength or quantity of Alkali contained in the refined sample, as seventy-six to one hundred.

It is needless to observe, that this mixture of clay, must in some degree injure the Alkali, with respect to its utility in most of the arts, to which Alkalies are applicable; and I shall add, that the refined Alkali, seems to me to be sufficiently pure for every purpose of arts, excepting perhaps those few instances, where the common Salt may be injurious. In all other respects, this Alkali is clean and well refined.

I am with much respect and esteem,

Dear Sir,

Your most obedient humble servant,

JAMES KEIR.

DR JOHNSON.

Good-

C H E M I S T R Y. 149

Goodman's Yard, January 9, 1787.

JESSE RUSSELL presents his compliments to DR JOHNSON, and in answer to his, the Indian Fossil Alkali is as under.

Refined Native Fossil Alkali	9
Rough Native ditto	7
Rough ditto from the Chest	7
Russia Pearl Ash	9
Good Barilla	7
Rough Pot Effex Ashes the very best	5½

The average price of Barilla, for the last three years, is twenty-seven pounds ten shillings.

The average price of Pearl Ashes, thirty-two pounds.

Mr FALSHAW's respectful compliments to DR JOHNSON, informs him he has tried the Indian fossil Alkali, and made Rochell Salt with it. It answered so well in the operation, that I esteem it more profitable than Barilla, by one twentieth; and more so than the best Pearl Ash, by eight per cent.

Other experiments I have not had leisure to make.

Old Fifth Street,
January 18, 1787.

P A P E R

E R R A T A.

- Page 59. line 6. for *Vegi-* read *Vege-*
61. 2. and page 63 line 10 for *embarkment*
read *embankment*
73. last but one, after *attending*, insert *it*
139. 8. for *sugar lead*, read *sugar of lead*
331. 1. for *aavantage*, read *advantage*